The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of Neil MacArthur, 301-540-2396, or Internet address neil.macarthur@hq.doe.gov, so we may issue a correction.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-14

March 28 through April 3, 1997

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EVENTS

1. LACK OF PROCEDURES AND INEXPERIENCED PERSONNEL CAUSE TRITIUM RELEASE

On March 29,1997, at the Mound Plant, approximately 10 curies of tritium were released to the environment when an inexperienced operator attempted to switch dryer towers while responding to a tritium alarm on the exhaust from an effluent removal system. The Environmental Protection Agency reportable limit for a tritium release from the stack is 100 curies over a 24-hour period. The operator, who was still in training, responded to the tritium alarm because the only two qualified operators were out of town. Formalized procedures for performing the evolution did not exist. The unavailability of qualified personnel to respond to facility events and the lack of operating procedures can result in unplanned environmental releases or equipment and facility damage. (ORPS Report OH-MB-EGGM-EGGMAT01-1997-0007)

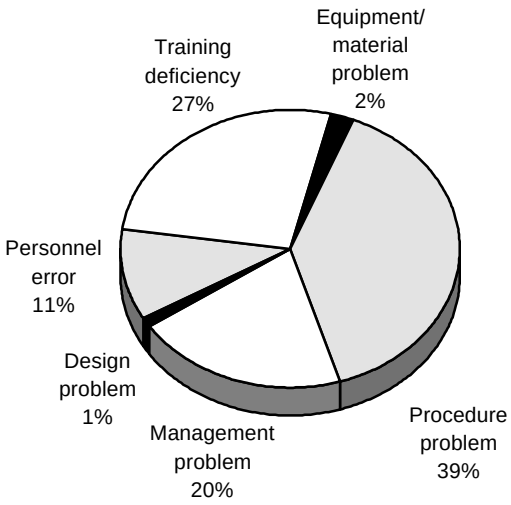
The inexperienced operator attempted to call both qualified operators for instructions on switching the dryer system line-up. Unable to reach either person, the operator proceeded to open valves to switch the dryers. He immediately put the valves back to their original positions when the stack alarm activated. Later, one of the experienced operators called back and talked the operator through the dryer-switching procedure. The other experienced operator returned to the site and brought the effluent removal system back to normal operation.

Investigators determined the tritium in the removal stream from the first dryer was inadvertently released to the exhaust stack because the second dryer was in a heating mode. The operator should have switched to a dryer in the cold standby mode to prevent the escape of tritium. Investigators determined improper resource allocation, insufficient practice or hands-on experience, and lack of procedures were the apparent causes of the event. Corrective actions included scheduling the availability of experienced operators to assure one qualified operator is available at all times and developing an effluent removal system checklist that covers the requirements for switching dryers and performing other critical operations for the effluent removal system during shutdown.

The unavailability of experienced operators was a major contributor to this occurrence. When there is a limited number of critical resources (personnel), it is important that at least one experienced person is available to respond to emergencies. The lack of formal written procedures for use during abnormal events was also a contributing factor.

A Type B investigation report of the March 31, 1994, fire and release of contamination at the TRISTAN experiment at Brookhaven National Laboratory identified similar concerns regarding lack of procedures and availability of experienced personnel. The experiment involved an on-line isotope separator located at a beam port of the High Flux Beam Reactor. The fire, which occurred on the midnight shift, resulted in a loss of $222,000. Investigators learned that operators did not understand the meaning of certain alarms. The alarms required a response by health physics personnel, but they were not available on the midnight shift. Also, operators and fire fighters did not know how to secure electrical power to the experiment until an experienced TRISTAN technician arrived. There were no procedures for alarm response or for electrically isolating the experiment in an emergency. (ORPS Report CH-BH-BNL-HFBR-1994-0005; Type B Investigation Report; Weekly Summary 94-40)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for occurrence reports with a direct cause of insufficient practice or hands-on experience across the DOE complex and found 94 reports. Figure 1-1 shows that facility managers reported procedure problems as the root cause for 39 percent of the occurrences. They also reported that training deficiencies accounted for 27 percent of the occurrences and management problems for 20 percent. Further review shows managers reported 73 percent of the procedure problems as lack of procedure.



Procedure Problem	Percent
Lack of procedure	73
Defective or inadequate procedure	27

Figure 1-1. Distribution of Root Causes for Occurrences with a Direct Cause of Insufficient Practice or Hands-On Experience[1]

This event illustrates the consequences of inexperienced or unqualified operators responding to facility events for which they may have only little hands-on experience or no formalized procedures to follow. Facility managers should ensure that their allocation of resources includes qualified personnel for support of off-shift working hours, as well as weekends and holiday periods. They should also ensure that procedures are formalized as an effective operator aid. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter I, "Operations Organization and Administration," states: "A high level of performance in DOE operations is accomplished by establishment of high operating standards by management . . . by providing sufficient resources to the operations department, by ensuring personnel are well trained . . . and by holding workers and their supervisors accountable for their performance in conducting activities. Chapter XVI, "Operations Procedures," requires that operations procedures provide direction to ensure the facility is operated safely and within its design basis. As stated in the Order, "Procedures should be developed for all anticipated operations, evolutions . . . and . . . should provide administrative and technical direction to conduct the intent of the procedure effectively. Sequence of procedure steps should conform to the normal or expected operational sequence."

[1] OEAF engineers searched the ORPS database for Direct Cause "5b" (insufficient practice or hands-on experience) and found 94 reports.

DOE 5480.20, *Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities,* states that the purpose of the Order is to assure that all persons are qualified to carry out their assigned responsibilities. Chapter I, sections 7.a.(1) and 7.a.(2), provide requirements for developing and maintaining training to meet the position requirements. DOE-STD-0102T, *Performance-Based Training Manual*, discuses developing training programs that ensure the training is conducted efficiently, effectively, and directly relates to job requirements. Facility managers should weigh the cost benefits associated with any significant effort to increase training or conduct of operations at facilities that will be shut down in the near future.

KEYWORDS: operating procedures, tritium, operator

FUNCTIONAL AREAS: operations, procedures

2. MECHANIC DONS AIR-SUPPLIED HOOD NOT CONNECTED TO BREATHING AIR

On March 25, 1997, at the Savannah River Site, an electrical and instrumentation mechanic donned an air-supplied plastic hood that was not properly connected to a breathing air supply. The mechanic was doffing his air-fed plastic suit after completing his work at a step-off pad in a high contamination airborne radiation area. An operator and a radiological operations inspector were assisting in cutting the mechanic out of the plastic suit. Because the mechanic remains inside the airborne radiation area during cut-out from the suit, an air-supplied hood must be donned when the upper part of the suit is removed. After the inspector provided him with the air-supplied hood, the mechanic realized that he did not have air to the hood. The inspector immediately notified the breathing air standby watch person. He checked the air supply pressure, but could not find a problem. The inspector then discovered the air-supply hose to the plastic hood had become disconnected from the air manifold. Failure to verify proper connection of hoses for air-supplied hoods and plastic suits can cause a loss of air supply and result in internal contamination or personnel injury. (ORPS Report SR--WSRC-LTA-1997-0012)

The radiological operations inspector immediately connected the breathing air hose to the manifold, restoring air supply to the mechanic's plastic hood. The mechanic exited the area and submitted nasal and saliva smears for analysis. Surveys of the mechanic found no detectable contamination.

A similar event occurred at the Savannah River Site on November 5, 1996, when an attendant gave a construction worker a fresh-air hood that was isolated from a breathing air supply. The construction worker was being cut out of his plastic suit as part of the area exit requirements. Investigators determined inattention to detail on the part of two attendees was both the direct and root cause. Management’s failure to maintain adequate control of the evolution and an inadequate pre-job briefing that failed to assign specific job responsibilities were contributing causes. Corrective actions included issuing a standing work order that requires verifying air-hood operation before it is used for cutout and revising procedures to include steps that require verifying air flow to the fresh-air hood. (ORPS Report SR--WSRC-ALABF-1996-0011)

NFS reported breathing air system problems in Weekly Summaries 96-52, 95-40, 95-36, 95-10, 94-43, 94-33, and 93-23. Weekly Summary 95-40 reported on September 28, 1995, a maintenance mechanic at the Mound Plant entered a controlled area wearing a

plastic suit that was not connected to a breathing air supply. After several minutes of attempting to connect an air hose to his suit, the mechanic started to have difficulty breathing and began to asphyxiate because of carbon dioxide collecting in his suit. A second mechanic recognized there was trouble, assisted him out of the controlled area, and tore off the plastic suit. Investigators determined that no one was in charge of the job and the pre-job briefing was inadequate. (ORPS Report OH-MB-EGGM-EGGMAT01-1995-0028)

These events emphasize the importance of ensuring that breathing air hoses are properly connected to air manifolds, hoods, and suits. Breathing air manifold attendants and wearers should perform a positive verification of quick-disconnect fittings to ensure locking rings are engaged to prevent accidental disconnection of hoses. The wearer or the attendant should verify air flow at the hood or into the suit before use. Facility managers should ensure that evolutions involving breathing air systems are properly supervised. Supervisors should assign responsibilities to attendants and standby personnel during the pre-job briefing to eliminate confusion as to who is responsible for air supply to the users. Respiratory protection training programs should train personnel on the immediate actions for a loss of breathing air.

KEYWORDS: breathing air, airborne radioactivity, respirator

FUNCTIONAL AREAS: industrial safety, radiation protection

3. ENGINEER SHOCKED BY CHARGED CAPACITOR

On March 26, 1997, at the Stanford Linear Accelerator Laboratory, an engineer received a shock when he contacted a charged capacitor while attaching a test probe inside a high-voltage cabinet. Investigators determined the engineer was testing a prototype modulator design in a high-voltage test cage. When the engineer jerked his hand from the cabinet, he received a slight cut. The engineer reported the incident to his supervisor who shut down the test and sent the engineer for a medical review. The medical staff examined the engineer and determined the only injury was the cut to his hand. Investigators determined that inattention to detail and failure to use proper safety procedures resulted in an electric shock. (ORPS Report SAN--SU-SLAC-1997-0005)

Investigators determined that after the engineer turned off the high voltage to the test cage he neglected to actuate a shorting device used to discharge storage capacitors. Because he had also neglected to attach a test probe to the device, he rushed to attach one. Investigators determined the engineer did not use a grounding hook to ground the capacitors and was not wearing personal protective equipment. Investigators determined the root cause of the event was failure to use proper safety procedures; inattention to detail contributed to the event.

The Power Conversion Department manager met with all department personnel and advised them not to hurry when conducting tests. He also directed them to adhere to the safety procedures and re-emphasized that they should use only one hand while working with high-voltage power supplies. The use of one-hand is to ensure a discharge path that could cause a fatality is not set up through a person's body . He also directed the following corrective actions.

- Power conversion technicians will install a grounding hook in the test areas for use after equipment is de-energized to ensure capacitors are discharged.

- Personnel will use personal protective equipment when working in high-voltage supplies.

- Power conversion technicians will post signs on high-voltage supplies, reminding personnel to use only one hand while working on them.

NFS reported on electrical shocks from capacitive discharge in Weekly Summaries 97-08, 96-51, 96-34, and 96-04.

- Weekly Summary 97-08 reported on February 11, 1997, at the Los Alamos National Laboratory Dynamic Experimentation Facility, a technician violated a standard operating procedure and caused a capacitor to discharge three times when he started to work on a high-voltage connector in an equipment rack. (ORPS Report ALO-LA-LANL-FIRNGHELAB-1997-0002)

- Weekly Summary 96-51 reported on December 5, 1996, at Sandia National Laboratory, a technician at the Explosives Component Facility received an electrical shock when his right hand came close to a high-voltage bank of capacitors. The discharge path through his body was from the bottom of his right wrist to his elbow where it was in contact with the grounded metal chassis. (ORPS Report ALO-KO-SNL-14000-1996-0004)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for incidents involving exposure to electrical hazard using a complex narrative search and discovery dates January 1, 1994 through December 31, 1996. They reviewed all of the reports for applicability and retained only those involving exposure to an electrical hazard. Figure 3-1 shows that as workers are exposed to electrical hazards, electrical shocks and injuries increase. There is a moderate, but significant, correlation between the rate of exposures and the rate of shocks and injuries. About 30 percent of DOE exposures lead to a shock or injury.

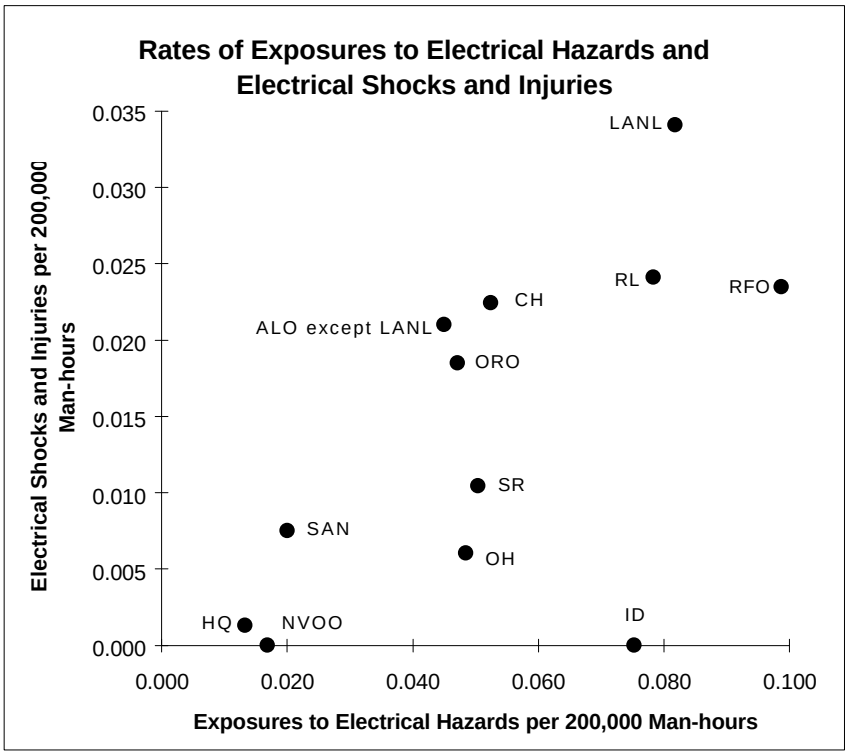


Figure 3-1. Rates of Exposures to Electrical Hazards and Electrical Shocks and Injuries[1]

This event underscores the importance of following safety procedures when working on electrical equipment. Equipment repair and testing may require technicians to work on energized equipment, thus exposing them to potential electrical hazards. High-voltage rubber gloves and safety glasses should be worn as a minimum. Workers also need to be aware of the stored electrical energy and shock hazard of capacitive discharge. Workers can be shocked from charged capacitors even if the equipment has been turned off or disconnected from external power. Facility managers should review the OSHA regulations contained in 29 CFR 1910, sub-part S, "Electrical"; 29 CFR 1926, sub-part K, "Electrical"; and 29 CFR sub-part V, "Power Transmission and Distribution." The regulations in 29 CFR 1910.147(d)(5) and .333(b)(2) require discharging, short-circuiting, and grounding capacitors if the stored electric power could endanger personnel. DOE-HDBK-1011/2-92, *DOE Fundamentals Handbook Electrical Science*, volume 2, contains an instructional section on capacitance. The section includes descriptions of capacitors, circuit diagrams, and electrical equations. According to the Handbook, the time it takes a capacitor to charge or discharge is called the capacitive time constant. The capacitive time constant is the time for the capacitor to charge or discharge to 63.2 percent of its fully charged

[1]OEAF engineers searched the ORPS database for all narrative "shoc@+short@+electrocu@+burn@ +expos@+energiz@+spark@+fire@dang@+lock@," and nature of occurrence code "+3A (occupational illness and injuries), -1G (unsatisfactory surveillance or inspections) and all narrative "electric@+volt@+kv@+(power lin@+condu@)+recepti@, -suspect@,-prevent@, -los@ and found 216 occurrences. The second part of the search, all narrative "shoc@+electrocu@+burn@" and nature of occurrence +3A (occupational illness and injuries), -1G (unsatisfactory surveillance or inspections) and all narrative electric@+volt@+kv@+(power lin@+condu@)+receipt@, -suspect@, prevent@,-los@, found 72 occurrences.

voltage. The time constant (in seconds) can be calculated as the resistance of the circuit (in ohms) times the capacitance of the capacitor (in farads). For a circuit with a 1,000 microfarad capacitor and 500 ohms of resistance, the capacitive discharge time would be 0.5 seconds. It takes five time constants for a discharging capacitor to drop to its minimum value.

DOE/ID-10600, *Department of Energy Electrical Safety Guidelines,* chapter 2.0, states that capacitive devices may retain or build up charge, so the circuit should be shorted or grounded. Section 7.0, "High Voltage Work in Excess of 600 Volts," provides guidelines for protective clothing and equipment and states that the worker should examine the work for existing hazards and proceed in a safe manner. Appendix A of the standard discusses the basics of electrical safety, the factors that increase the potential for electrical shock, and the effects of electricity on the human body. Section A-6, "Body Resistance Model," discusses the small amount of current it takes to cause the heart to go into ventricular fibrillation. The example given states that only 50 milliamperes of current is required when energized by a 120-volt AC supply. Appendix C provides work matrices of electrical safety requirements for various working voltages. The matrices identify the recommended test equipment and describe tools for each type of electrical work activity.

KEYWORDS: capacitor, electrical, high voltage

FUNCTIONAL AREAS: industrial safety, electrical maintenance

4. ENERGIZED CABLE CUT AT HANFORD

On March 25, 1997, at the Hanford N-Reactor, decontamination and decommissioning workers cut through a conduit into an energized 220-volt cable. Markings on the conduit indicated the cable was de-energized and a zero energy check had been completed. When the workers cut the conduit and wire they observed arcing and sparking. No one was injured. The workers stopped work, left the area, and notified their supervisor. Investigators determined that the workers bypassed hold-points required by the procedure. They also determined the assigned electrician did not conduct a zero energy check. Failure to follow procedures and conduct zero energy checks created the potential for injury and equipment damage. (ORPS Report RL--BHI-NREACTOR-1997-0006)

The area superintendent convened a critique to review this event. Critique members determined the electrician signed off the hold-point that required zero energy checks based on his confidence that the system was de-energized. He did not actually perform the zero energy check. Critique members also determined that the work package did not specify the source, type, or magnitude of hazardous energy as required. They also determined the work package required workers to trace the system and identify the isolation point. The controlling organization would then have issued a lock and tag.

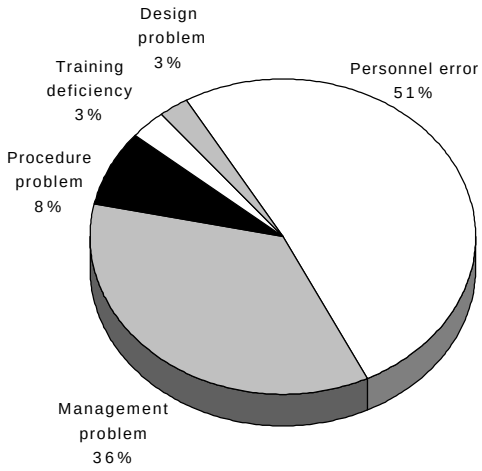
The area superintendent held a meeting with all area supervisors and craft persons. He discussed this event and stressed the importance of personnel safety and procedure compliance. He directed personnel to ensure that all of the required hazardous energy information is included in work packages and procedures involving lockouts and tagouts. He also stressed that specific identification of the isolation point must be included in the isolating instructions. The contractor is conducting a root cause analysis and will develop corrective actions to preclude similar events.

NFS reported electrical safety procedure violations in Weekly Summaries 96-47, 96-45, and 96-08.

- Weekly Summary 96-47 reported that on November 14, 1996, at the Savannah River Site, facility managers at Central Services Works Engineering issued a stand-down order to a subcontractor for violating site safety procedures. The subcontractor electrician did not wear gloves designed for use on low-voltage circuits when he conducted voltage checks on a known energized circuit and failed to remove metallic jewelry while performing the task. (ORPS Report SR--WSRC-CSWE-1996-0010)

- Weekly Summary 96-45 reported that on October 29, 1996, at the Waste Isolation Pilot Plant, a waste-handling supervisor discovered that a maintenance technician signed off a preventive maintenance instruction before performing the required steps. (ORPS Report ALO--WWID-WIPP-1996-0007)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for procedure violations and found 497 final occurrences. Figure 4-1 shows facility managers reported personnel errors as the root cause for 50 percent of procedure violations across the DOE complex over the last 12 months. Further review shows that 43 percent were reported as inattention to detail and 43 percent were reported as procedure not used or used incorrectly.



Personnel error	Percent
Inattention to detail	43
Procedure not used or used incorrectly	43
Communication problem	7
Other human error	7

Figure 4-1. Distribution of Root Causes for Procedure Violations[1]

These events underscore the importance of following procedure steps and conducting the required procedure actions. Failure to do so could result in injury or a fatality. DOE facility managers should ensure that workers understand the importance of following procedures and safety rules. DOE/ID-10600, *Electrical Safety Guidelines*, prescribes DOE safety standards for the use of electrical energy at DOE field offices or facilities. Section

[1] OEAF engineers reviewed the ORPS database for Nature of Occurrence "01F@" (violation or inadequate procedures) and found 487 final occurrence reports for the period 3/1/96 through 3/1/97.

2.13.1.3 states that when circuits and equipment are worked on they must be disconnected from all electrical energy sources. Section 2.13.2 requires verification that all live circuits are disconnected, released, or restrained. Section 2.13.2.1 requires a qualified worker to use test equipment to check the circuit elements and electrical parts and verify that they are de-energized. These guidelines are intended to protect personnel from electrical shock and potential fatalities. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, states that DOE policy is to operate DOE facilities in a manner to assure an acceptable level of safety and to ensure procedures are in place to control conduct of operations. Chapter VIII, "Control of Equipment and System Status," provides an overall perspective on control of equipment and system status. Specific applications of system control are addressed in chapter IX, "Lockout/Tagout," and chapter X, "Independent Verification." DOE-STD-1030-96, *Guide To Good Practices For Lockouts And Tagouts*, provides guidance on lockout/tagout program implementation and management at DOE facilities.

KEYWORDS: decontamination and decommissioning, electrical, procedure violation, safety

FUNCTIONAL AREAS: decontamination and decommissioning, procedures

5. SAMPLES NOT RECORDED IN SAMPLE DATABASE

On March 29, 1997, at the Hanford Analytical Laboratory, the shift manager discovered five grab samples received from the 242-A evaporator since March 26, 1997, were not logged into the laboratory's core-equivalent sample database in accordance with the administrative and operating procedures. The core-equivalent is a value assigned to a sample that is isotope-dependent in order to track all isotopes in the facility and ensure they remain below one-third critical mass. Investigators determined there were no violations of the core-equivalent sample limit. Investigators determined the workers who received the samples failed to recognize they needed to log the samples into the database because they did not know the procedure addressed this type of sample and did not reference the procedure. They also believe that inattention to detail contributed to this event. Failure to understand and use procedures correctly and lack of attention to detail create the potential for exceeding the core-equivalent limits. (ORPS Report RL--PHMC-ANALLAB-1997-0008)

The operations manager convened a plant review committee meeting to review this occurrence, determine causes, and identify corrective actions. Members determined that the procedure controlling the logging of samples was confusing and needed to be revised. They further determined the form used to request a sample analysis, which is received with samples, does not alert laboratory workers to the disposition of incoming samples. Members also determined that samples requiring entry into the database were received infrequently. They also determined the laboratory has not been proactive in the receipt of samples.

The operations manager directed the following corrective actions.

- The process chemistry manager will modify the operating procedure to include a statement to log all samples received in shielded containers into the core-equivalent sample database. He will also develop a method for dealing with non-routine or infrequently received samples.

- The process chemistry manager and the environmental compliance manager will review the form used to request a sample analysis and will modify it as necessary. They will notify all customers of the changes and inform them that samples will be returned if the form is not completed correctly.

- The process chemistry manager and project coordinators will develop a forecast listing the samples that will need to be logged into the core-equivalent sample database. This will allow the project coordinators and sample custodians to know in advance which samples require core-equivalent entries.

NFS reported procedure violations and inattention to detail at laboratories in Weekly Summaries 96-50, 96-38, 96-36, 96-33, and 96-15.

- Weekly Summary 96-50 reported that on December 8, 1996, at the Savannah River H-Tank Farm, two operators and a laboratory technician transported samples from two storage tanks to the site analytical laboratory in violation of a site Radiological Control Manual requirements to use a sample control procedure if the dose rate exceeds 5 mrem/hr. The samples from the two tanks indicated dose rates of 6 mrem/hr and 10 mrem/hr. (ORPS Report SR--WSRC-HTANK-1996-0027)

- Weekly Summary 96-15 reported on April 3, 1996, at the Hanford Analytical Laboratory, a chemical technologist inadvertently poured concentrated nitric acid into a bottle containing ethanol. The chemical reaction forced the mixture out of the container, through the arm port of the fume hood, and onto the technologist's face. A radiological control technician surveyed the technologist who showed no radiation contamination; however, he sustained acid burns on his face. (ORPS Report RL--WHC-ANALLAB-1996-0016)

This event illustrates the importance of writing operating procedures that are accurate and eliminate areas of confusion. DOE-STD-1029-92, *DOE Writers Guide for Technical Procedures,* establishes the recommended process for developing technical procedures that are accurate, complete, clear, and consistent. The guide provides guidance for developing a procedure basis; planning, organizing, and structuring the procedure; developing content and establishing format; and writing action steps. Procedure writers should request reviews by relevant organizations and personnel to ensure procedures are accurate and contain the appropriate level of detail. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities,* provides requirements and bases for writing, verifying, and validating technical procedures. DOE and facility managers should review their procedures to ensure they meet the requirements of this standard.

KEYWORDS: laboratory, procedures, sampling

FUNCTIONAL AREAS: procedures

6. MISSING FLOOR MARKINGS INVALIDATE AUDIBILITY TEST

On March 26, 1997, at the Savannah River Site, DOE personnel discovered that sound-survey floor markings used for nuclear incident monitor audibility tests were no longer visible. Facility test personnel performed a test on March 14, 1997. However, because of this finding, DOE management questioned whether the decibel readings taken on March 14 met the acceptance criteria for the test procedure. The facility manager declared all facility nuclear incident monitor bells inoperable until personnel re-paint the location marks and re-test the bells. Failure to preserve floor markings used as data-collection reference points invalidated test results for systems that are required for nuclear criticality safety. (ORPS Report SR--WSRC-SEPGEN-1997-0001)

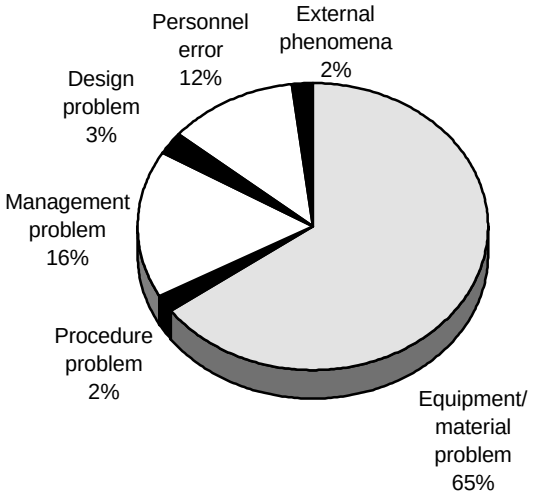
On March 27, 1997, as a follow-up to the discovery of this issue, personnel at another Savannah River facility performed a walk-down using the nuclear incident monitor bell audibility testing procedure. They discovered that several of their sound-survey floor markings were also missing.

Investigators determined the test procedure directed the tester to a survey location approximately 10 feet from the nuclear incident monitor bell. The exact location was to be designated by a mark painted on the floor. The intention of the floor marking is to maintain consistency in test-result data for comparison purposes. Investigators determined test personnel failed to comply with the test procedure when they encountered missing sound-survey markers. They continued to test the audibility of the bells, even though they could not determine the location of the marker. Because the procedure directed them to a marker, the testers should have stopped the test when they did not see it.

DOE facility representatives have also questioned whether the present sound-survey locations (10 feet from bell) meet the intent of the surveillance test; that is, to verify audibility of the bell in all areas of coverage. Safety engineers are currently addressing this concern.

NFS reported problems associated with the audibility of criticality accident alarm systems in Weekly Summaries 97-07, 96-27, 96-24, 96-20, and 96-04. Weekly Summary 96-24 reported on June 7, 1996, at the Paducah Gaseous Diffusion Plant, an unreviewed safety question existed because the horn for a portable criticality accident alarm system did not produce acceptable sound levels in all areas of a laboratory. (ORPS Report USEC--MMUS-PADGENPLT-1996-0021)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for unsatisfactory surveillances and inspections across the DOE complex and found 152 occurrences for the last 12 months. Figure 6-1 shows that facility managers reported equipment/material problems as the root cause for 65 percent of the occurrences. They also reported that management problems accounted for 16 percent and personnel errors accounted for 12 percent of the occurrences. Further review shows that 79 percent of the equipment/material problems were reported as defective or failed parts.



Equipment/Material Problem	Percent
Defective or failed part	79
Contaminant	8
End-of-life failure	8
Defective or failed material	5

Figure 6-1. Distribution of Root Causes for Unsatisfactory Surveillance/Inspections[1]

This event underscores the importance of procedural compliance. The event could have been avoided if test personnel had stopped the test when they could no longer comply with the procedure steps. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, provides guidelines and requirements for preparing, approving, changing, and using operations procedures. Facility personnel should review this guidance, particularly as it relates to procedure compliance. This event also illustrates the importance of preserving markers used to identify data collection locations.

ANSI/ANS-8.3, *Criticality Accident Alarm System*, provides direction for establishing and maintaining criticality and nuclear incident alarm systems. Section 4.4.1 requires quarterly checks of audible alarms in areas that may require personnel evacuation. The standard states that alarms are for immediate evacuation and shall be of sufficient volume and coverage to be heard in all areas to be evacuated.

KEYWORDS: criticality safety, surveillance, test, procedure

FUNCTIONAL AREAS: nuclear/criticality safety, surveillance, procedures

[1]OEAF engineers reviewed the ORPS database for Nature of Occurrence “1G” (unsatisfactory surveillance/inspections) and found found 149 final reports with 152 occurrences for the period 4/1/96 through 4/3/97.